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Message to California Air Resources Board:  
Aggressive Reduction in Greenhouse Gas Emissions  
Is Essential for California's Economy and  
Survival of Civilization

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As the Air Resource Board Members contemplate the GHG emission standards, they should remember the legacy that they have inherited from past actions of the board. The original board was chaired by Dr. Areie Haagen-Smit, a professor at CalTech. Under his leadership the emission standards developed and implemented by the board became the future standards for our nation. Ultimately these standards lead a world-wide movement to clean air in the developed countries. A brief visit to Mexico City, Beijing, or Hong Kong on a typical day will reveal the value of these standards. Today the California gasoline standards for lead, sulfur, benzene and other poisonous substances are stricter here than elsewhere to the benefit of Californians.

The scientifically based activities of the Board were opposed vehemently by the political and public relations pressures sponsored by the established automobile and gasoline industries. However, the early Board had a strong ally: the harmful effects of SMOG were obvious to anyone who could either breathe or see. I grew up in Los Angeles in the 60s and remember days in which a brown haze was evident even when looking at 20 feet. The air stunk with a glue-like odor many days of the year. The connection between the growth of automobile emissions and stationary source emissions and its consequences to the air quality were unmistakable. Even with intensive growth in industry and automobile travel in the past 50 years, those horrible SMOG days have not been repeated. Auto emissions have been reduced by a remarkable 99%.

Today's Board faces a more daunting challenge than past Boards. The consequences of GHG emissions are not directly observable to the senses as was the SMOG of the 60s. Carbon Dioxide and many of the other GHG pollutants are odorless and colorless. The connection between GHGs and climate change is exceptionally well founded in science-backed by extensive modeling and observations of recent climate change, but is not observable to our senses. However, this does not make the association any less valid.

The other challenge facing the Board is that the economy of California, indeed the economy of the developed world, is facing enormous challenges not seen since the Great Depression. Many falsely argue that this is the wrong time to impose strict reduction of GHG emissions. I would argue the opposite is true. Because of the increasing effects of climate change, the global scarcity of oil, and the realization (as demonstrated by the Gulf of Mexico BP disaster) the serious environmental consequences of extraction at sea, the global community will move to renewable energy sources. California's economy has depended on being on the forefront of new innovations. At one time in the 30's when Hollywood's Film Industry was established – this was high tech! The transistor, the microprocessor, gene-spliced medicines, user-friendly electronics and many other first have dominated both our economy and our culture of leadership. We cannot afford to give up these types of initiatives. In recent years, 500,000 green jobs have been added to our workforce.

California, thru the actions of the Board, has an opportunity to lead the world to a green economy and avoid the most catastrophic consequences of man-made climate

change. Several of the issues surrounding climate change are not that well publicized beyond the scientific community and I will attempt to do so here.

I would like to make the following points:

1. The global average temperatures have been going up as shown in Figure 1. What is not well recognized is that while the temperatures have gone up, some of the additional heating caused by GHGs has been slightly offset by a decline over the last decade in solar intensity. As seen from Figure 1, there is a well established 22-year sun cycle and we are now entering a period of increasing intensity. So over the next decade, both GHG heating and solar intensity heating will be acting together.
2. The "extra" carbon dioxide molecules will remain in the atmosphere for centuries. As shown in Figure 2, the rate of absorption of carbon dioxide is very slow, and in fact may proceed less rapidly than this figure reveals as many of the sinks of carbon dioxide, such as the ocean, become saturated. Thus today's decisions will have implications for many generations to come, if not the survival of humanity. Figure 2 shows the result of only one scientific report, but the literature, much of it summarized in the IPCC report, reveals many other studies will similar results.
3. The climate change will result in the continued melting of Arctic Ice and ice sheets of Greenland. The graphs in Figure 3 reveal the upward trends of ice melting and rising sea levels. Of course, as a coastal state, our state will be directly impacted by the rising sea levels. Because the persistence of the GHG gases in the atmosphere, the restoration of sea levels is going to be many centuries in the future.
4. The consequences of climate change will be disastrous to a large portion of the earth's population. Figure 4 shows a map of the rivers that feed off of the Himalayan glaciers. If the glaciers there should melt and no longer store water for the dry season, the water supplies for hundreds of millions of people will be lost essentially forever.
5. Even experience of past government commitments to reducing GHGs is very poor. Europe never reached the goals set forth by the agreement in the late 90s. Several authors have analyzed the potential of goals that were considered at the recent Copenhagen Conference. Those goals, even if modestly met would have still resulted in drastic changes in the climate. As Figure 5 shows, we can expect temperature rises well above 2 degrees C. Currently we are experiencing about half a degree from pre-industrial levels. So the frequency of extreme weather events, such as the floods in Pakistan, and drought in Russia, will become more common place.
6. The most distressing aspect of climate change is that man-made GHGs may cause sufficient heating to release billions of tons of GHGs stored in methane hydrates which lie in deep, cold regions of the ocean; and organic carbon, which has been buried for millennia, in the Tundra under meters of ice and snow. If the temperatures rise sufficient to release these GHGs, then the earth will undergo enormous climate changes that will then be beyond mankind's ability to control.

Climate scientists refer to the "Venus Syndrome." This is the prospect that the earth's atmosphere will contain so much GHGs that the temperatures will rise throughout the world so life everywhere will vanish. Venus has such an atmosphere and has average temperatures of 700 F, which is higher than Mercury's temperature. Mercury is much closer to the sun than Venus. In his recent book, *Storms of my grandchildren*, climate-scientist James Hansen states:

With methane hydrate emissions added on top of those from conventional and unconventional fossil fuels, the future is clear. Diminishing feedbacks that help to keep the magnitude of natural long-term climate changes within bounds, such as the ability of long-term carbon cycle to limit atmosphere carbon dioxide, will have no time to counter amplifying feedbacks. The huge planetary imbalance caused by the high levels of atmospheric carbon dioxide will take care of any remaining ice in a hurry. The planet will quickly get on the Venus Express.

As the Board considers emission standards, Board members should realize the historic role they have inherited. Across the world, there are no other significant political entities with the power and the potential will to turn the current global dependence on fossil-fuel energy from devastating the planet. Politicians across our country are running on platforms that even deny the existence of man-made climate change. The political pressures exerted by the enormous economic power of the fossil fuel industry are influencing decisions across the world.

If not this Board, now, then who when?

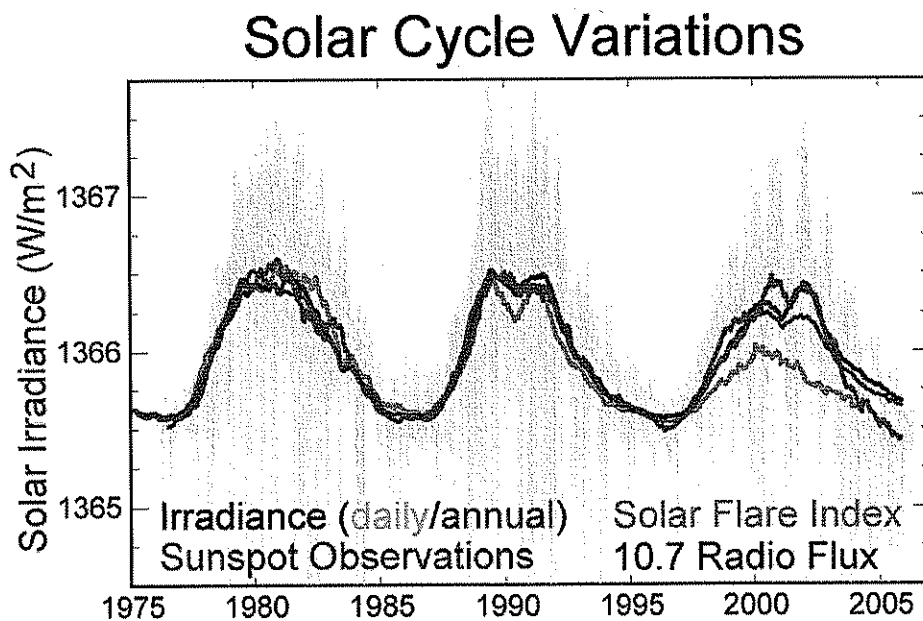
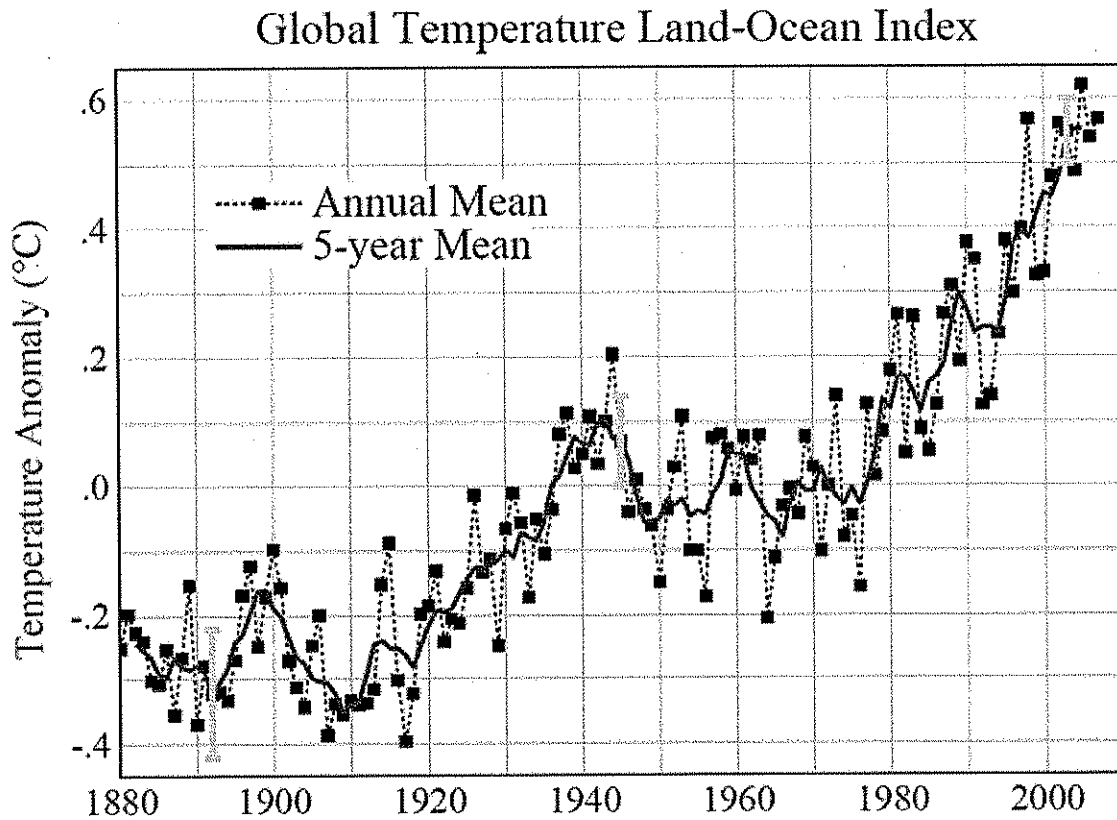


Figure 1 - Global Warming will worsen as Solar Intensity Increases  
 The top graph is from a recent article by James Hansen on world wide average temperatures. The lower one is from Wikipedia. Clearly the sun's intensity will increase over the next decade that will lead to even greater temperature increases as GHG emissions remain stable or increase.

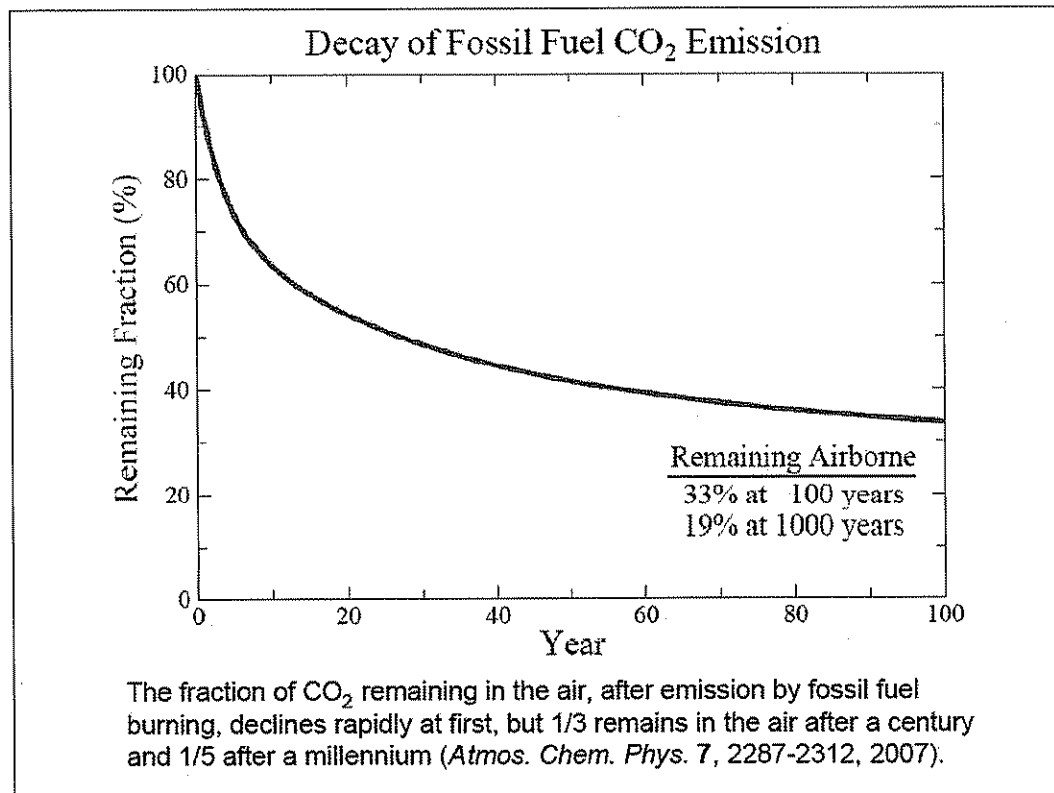
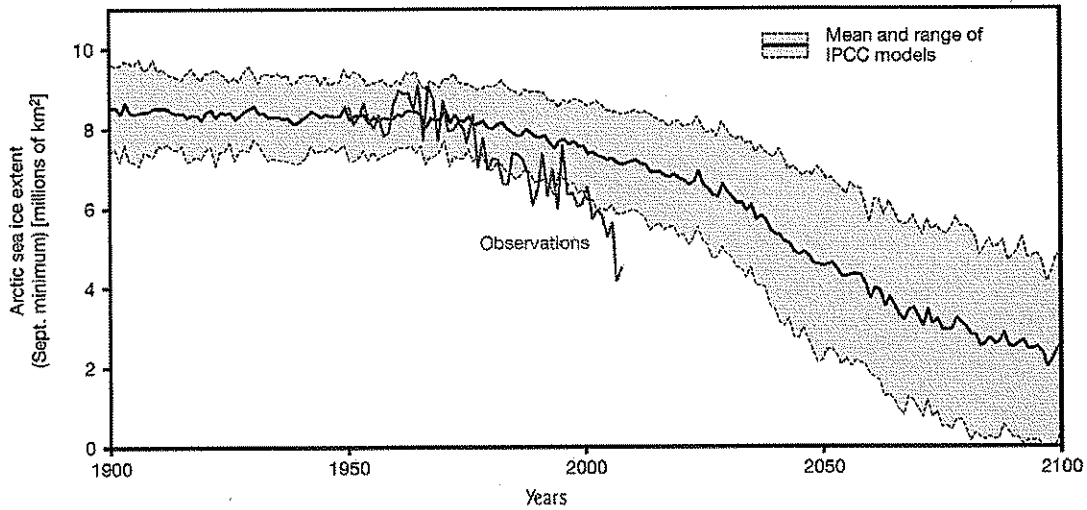
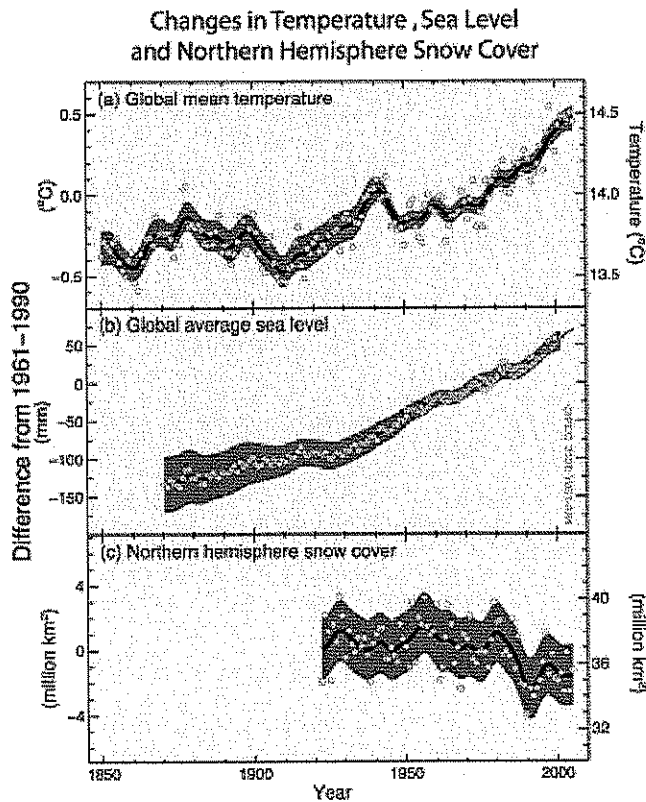


Figure 2 – Time Delays in Reabsorption of GHGs

The above figure is representative of several studies done and reported on in the IPCC report. All the studies show that carbon dioxide will remain in the atmosphere for centuries. Thus today's increases in carbon dioxide will be reflected in the ecology of the earth for the next several centuries.



**Figure 13.** Observed (red line) and modeled September Arctic sea ice extent in millions of square kilometers. The solid black line gives the ensemble mean of the 13 IPCC AR4 models while the dashed black lines represent their range. From Stroeve et al. (2007) updated to include data for 2008. The 2009 minimum has recently been calculated at 5.10 million km<sup>2</sup>, the third lowest year on record, and still we



**Figure 3** Ocean Levels will Rise and Ice Covering will Reduce  
Global warming will increase the levels of ocean by causing expansion of the ocean waters as their temperature increases and reduction in both sea-ice (ice floating on water) and ice sheets (ice on land such as Greenland and Antarctica). Removal of surface ice will further increase the earth's temperature.

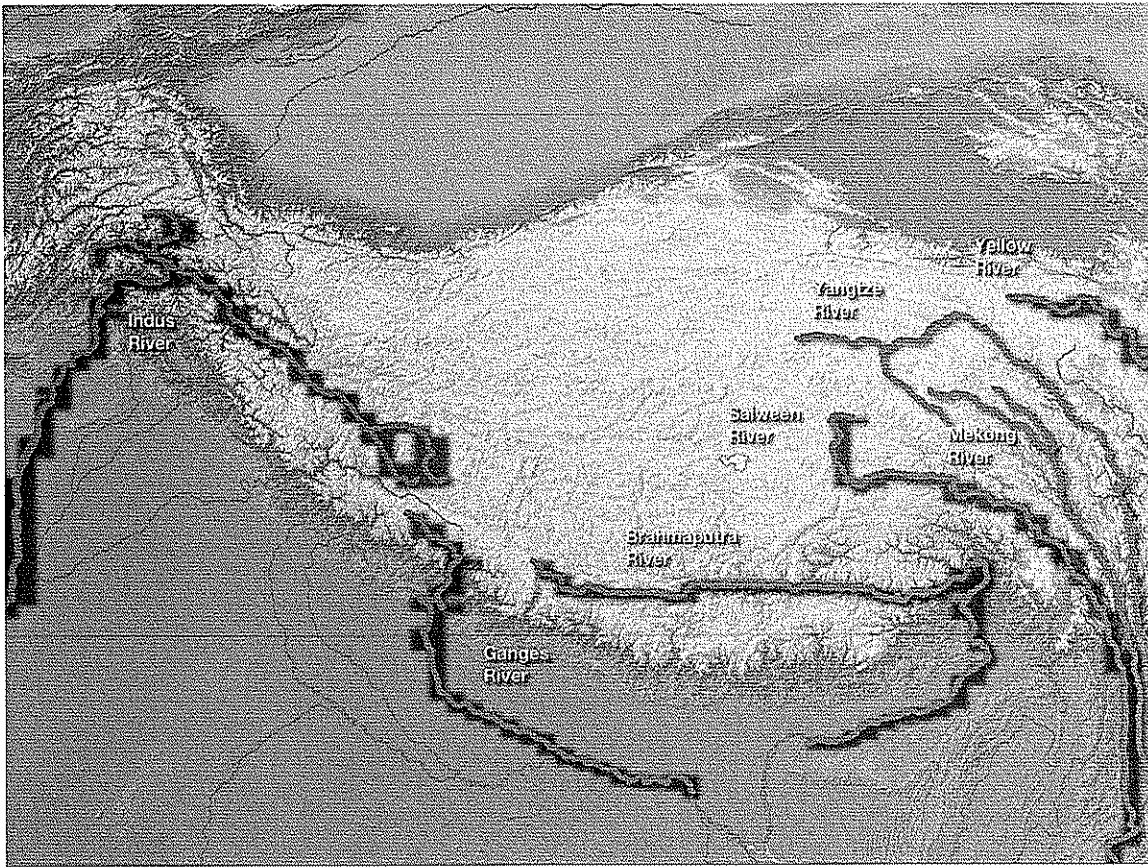


Figure 4 The Himalayan Ice is Melting

As the ice melts and loses its capacity to store water during the dryer seasons, the source of water for these many rivers is threatened. Consequently, the water supply for millions is in jeopardy.



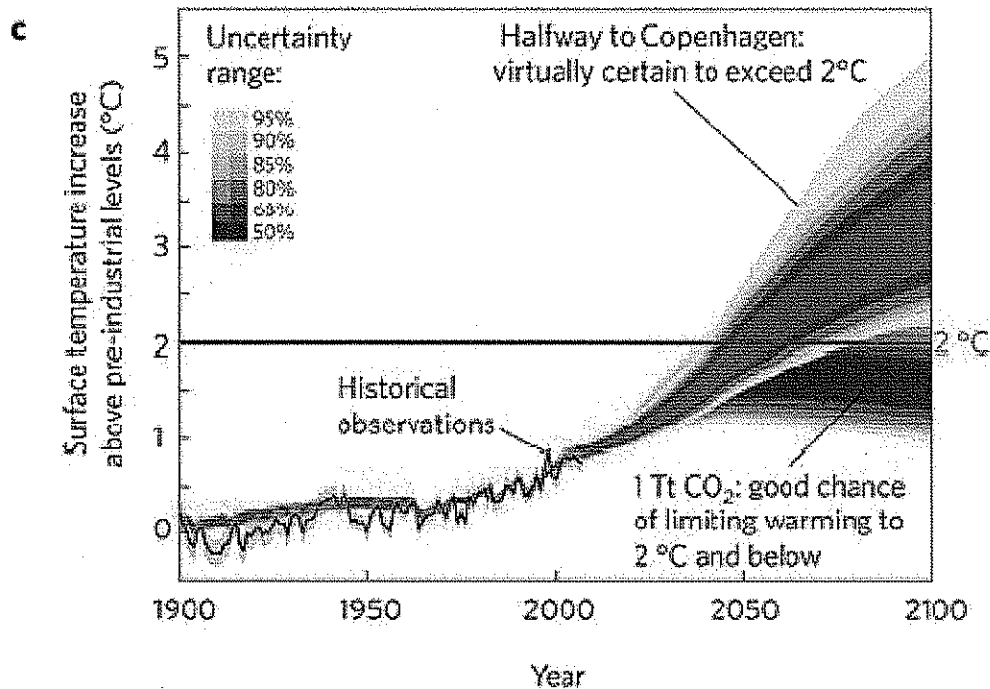


Figure 5. Substantial Temperature Increases are Inevitable

This figure is from a recent publication by Rogelj, Joeri, et al. They characterize the future temperature increases based on a partial implementation of the goals that were suggested for the Kyoto Protocol at the Copenhagen Conference. As their study and others found, even reasonable adherence to the goals (which were NOT adopted with any conviction at the Conference) would result in very large temperature increases. In short, we have gone to far so as to avoid major consequences for generations.